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ABSTRACT

This module, the first of four units about vocational competency measurement, is module 17 in the Vocational Education Curriculum Specialist series. The purpose stated for the document is to trace the growth of the formal measurement of skills, knowledge, and attitudes in vocational programs and to present some uses of competency testing in vocational programs. Content is organized into three sections, each of which focuses on one goal and two or more objectives. Section 1 examines the growth and significance of student competency testing in vocational education programs. In the second section, the components that make up a comprehensive set of vocational competency measures are described. The discussion also covers definitions used for various testing techniques. The module concludes with an overview of the uses of competency measures for evaluation, instruction and administration, and communication among instructors, administrators, students, and parents. Each section concludes with individual study activities, discussion questions, and group activities. Self-check items and possible responses to them are appended for use as a pretest and review of the module content. (YLB)

ED227353

USING COMPETENCY MEASURES IN VOCATIONAL EDUCATION PROGRAMS

Module 17

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INTRODUCTION

ACKNOWLEDGMENTS

The discussions and techniques presented in Modules 17 through 20 of the VECS series are based on the work of the American Institutes for Research in carrying out the Vocational Competency Measures (VCM) project under contract with the Office of Vocational and Adult Education, U. S. Department of Education. The project was a major effort, beginning in October 1979 and continuing through 1982, to provide a national model for vocational competency test development.

The VCM project had four major objectives:

(1) To develop competency tests in selected occupations, representing each of the seven major areas: trade and industry, home economics, health, distributive education, technical, business and office, and agriculture;

(2) To establish their usefulness through extensive field testing and evaluation;

(3) To promote their acceptance and use in vocational education programs;

(4) To design and help implement a program for continuing occupational competency test development on a self-supporting basis.

The successful implementation of the project was due to the efforts of many people. Senior project staff responsible for specific tasks were:

Dr. Albert B. Chalupsky, Project Director
Ms. Marion F. Shaycoft, Director of Sampling and Test Quality Control, and Test Team Leader
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Mr. Steven Zwillinger, Department of Education Project Officer, provided support to staff throughout the project.

Introduction

This is the first in a series of four modules about vocational competency measurement. The purpose of this module is to trace the growth of the formal measurement of skills, knowledge, and attitudes in vocational programs, and to present some uses of competency testing in vocational programs. The next module, Module 18, discusses how to determine requirements for vocational competency measures. Module 19 presents a step-by-step approach to developing the competency tests, and Module 20 considers approaches to validating competency tests and using test results. The discussion presented here is based on the experiences of the American Institutes for Research in conducting the Vocational Competency Measures (VCM) project for the U.S. Department of Education.

Overview

The first section of this module examines some of the early history and points out the importance of the military services in the development and use of competency measures. Current efforts are described in a review of ongoing projects that assess occupational competencies of students in vocational training programs.

In the second section, the components that make up a comprehensive set of vocational competency measures are described. The discussion also covers and clarifies the definitions typically used for various testing techniques.

The module concludes with an overview of the ways vocational educators and administrators can use competency measures to plan, evaluate, and improve vocational programs. Recommendations are included for using the components of a comprehensive competency test package to enhance communication among instructors, administrators, students, and parents.

Instructions to the Learner

The Self-Check items and possible responses to them are found in the Appendices. These questions have two purposes. First, before you begin work on the module, you may use them to check quickly whether you have already learned the information in previous classes or readings. In some instances, with the consent of your instructor, you might decide to skip a whole module or parts of one. The second purpose of the Self-Check is to help you review the content of modules you have studied in order to assess whether you have achieved the module's goals and objectives.

You can also use the list of goals and objectives that follows to determine whether the module content is new to you and requires in-depth study, or whether the module can serve as a brief review before you continue to the next module.

Goals and Objectives

Goal 1: Summarize and explain the growth and significance of student competency testing in vocational education programs.

Objective 1.1 Describe the major contributions competency testing has made to vocational education programs.

Objective 1.2 Identify some competency testing efforts that historically have provided a foundation for current development.

Objective 1.3 List three current major competency test projects.

Goal 2: Describe the components of comprehensive student vocational competency measures, and define testing techniques making up those components.

Objective 2.1 Identify the three main instruments included in a comprehensive set of student competency measures.

Objective 2.2 Define criterion- and norm-referenced testing.

Goal 3: Analyze the use of competency measures for evaluation, instruction and administration, and communication.

Objective 3.1 Describe some uses of competency measures for evaluating vocational programs.

Objective 3.2 Identify the major uses of competency measures for improving instruction and administration for vocational programs.

Objective 3.3 Discuss the uses of comprehensive competency measurement for increasing and facilitating communication among various interest groups.

Resources

In order to complete the learning activities in this module, you will need information contained in the following publication:

Erickson, R.C., & Wentling, T.L. Measuring student growth: Techniques and procedures for occupational education. Urbana, Ill.: Griffon Press, 1976.

GOAL 1

GOAL 1: Summarize and explain the growth and significance of student competency testing in vocational education programs.

Why So Much Attention To Student Competency Testing?

Traditionally the evaluation of vocational education has focused on learner outcomes, whether or not the vocational program was labeled objectives-based, performance-based, or competency-based. Most often the "outcome" boiled down to the question: "Did the graduate obtain a job in a field directly related to the content of the vocational training?"

How can we argue with this ultimate of "bottom-line" indicators? What could possibly be wrong with so objective a measure as employment? For one thing, this presumes that the primary objective of all students is to obtain a job in the field where vocational training is received. Vocational educators know that this is not the case. Just ask any teacher of a high school auto shop course.

Another problem with the narrow focus on employment as the criterion for evaluating vocational education, especially at the high school level, is that employment is heavily affected by both national and local economic conditions. In fact, the 1979 evaluation report of the U.S. Department of Health, Education, and Welfare states that "...economic conditions probably much more powerfully influence employment among youth than curriculum choice" (p. 496).

It is not surprising, then, that a growing number of individuals concerned with the evaluation of vocational education are also asking the question: How well can vocational program graduates do the jobs for which they were trained? This increasing trend toward measuring student competencies (skills, knowledge, and attitudes) is reflected in a recent review of studies covering vocational education outcomes (Taylor, Darcy, & Bolland, 1979).

Current federal legislation supports this growth in competency measurement. For example, the Rules and Regulations for the vocational education section of the Educational Amendments of 1976 (Public Law 94-482) prescribes that the State Board "evaluate in quantitative terms the effectiveness of each formally organized program or project supported by federal, state, and local funds...in terms of:

Results of student achievement as measured, for example, by:

- Standard occupational proficiency measures
- Criterion-referenced tests

- Other examination of students' skills, knowledge, attitudes, and readiness for entering employment successfully."

But the evaluation of vocational program effectiveness is certainly not the only reason for the growing attention to the measurement of student competencies. If you are associated with a competency-based vocational education (CBVE) program, especially one that involves open entry or open exit, you know how critical student competency measurement is to many program functions--not just a program evaluation.

Just look at the following features of exemplary CBVE programs that Russell found in a recent survey (1978, pp. 5-56) to see how closely CBVE is tied to student competency testing:

- Pre-testing students upon entry to determine the skills they already have as well as objectives that need to be achieved
- Allowing each student to proceed to subsequent instruction as soon as performance objectives are attained
- Providing an alternative method of instruction if a student does not achieve a learning task
- Recording student performance as each objective is achieved
- Placing greater emphasis on exit requirements (proficiency) than on entrance requirements
- Assessing students on the basis of competencies

Indeed, a comprehensive vocational competency measurement program can be a tremendous resource for teaching and administration from the time of initial assignment through graduation. It can also help satisfy the demands for information that students, parents, and employers are making upon vocational educators today.

Even with all of these uses we have not exhausted the potential contribution that competency measures can make to the improvement of vocational education. In a joint report, the American Association of Community and Junior Colleges and the American Vocational Association noted the problem of articulation among vocational education delivery agencies and recommended the following for improving cooperation:

> The U.S. Office of Education should, through the Bureau of Occupational and Adult Education, develop a data bank of competencies needed by individuals to enter or quality for work in a broad range of occupations. Appropriate criteria for assessing whether or not the competencies are achieved should also be required (1978, pp. 22-23).

Some Early History

The formal measurement of competency in task performance can trace its roots back to the early history of the testing movement. As noted by Hale (1982) in his comprehensive review of the history of employment testing, as far back as 1814 the Army had already instituted examinations for surgeons. The military, in both World Wars I and II, contributed significantly to the use of tests for personnel classification and performance evaluation. Chapman, in 1921, noted that one of the important outgrowths of World War I Army Personnel Research was the development of the trade test. This instrument was devised, in his words, "to make it possible for a trained examiner, unskilled in any particular trade, to measure in objective terms the trade standing of any recruit claiming skill in any of the several hundred trades necessary to the work of the Army" (p. v).

Chapman, a member of the Army Trade Test Division of the Committee on Classification of Personnel, defined "trade" much the way "occupation" is defined today, and hence the term "trade test" was used synonymously with "occupational test" and "professional test." It encompassed such diverse occupations as those of a surveyor, cook, statistician, and typist. Trade ability, according to Chapman (1921, p. 12), signified "what is commonly meant by a person's competency to follow a trade, occupation or profession."

World War II and the decade that followed gave another boost to competency testing, with special emphasis on measuring the proficiency of aircraft pilots and equipment maintenance personnel (Flanagan, 1948). In an extensive review of this research and its applications, Glaser and Klaus (1962) discuss the problems of measuring proficiency of the human component in man-machine systems.

Today, the military still stands as one of the major developers and users of occupational competency measures. Other organizations, particularly large businesses, are also showing increasing interest in testing. While the number of these organizations is growing, much remains to be done before we can truly say that occupational competency testing has reached its full potential. In his sweeping criticism of the wholesale use of intelligence tests by schools, colleges, and employers, McClelland (1973) calls for competency testing as an alternative approach. As viewed by McClelland (p. 7), "the best testing is criterion sampling... There is ample evidence that tests which sample job skills will predict proficiency on the job... Criterion sampling means that testers have got to get out of their offices where they play endless word and paper-and-pencil games and into the field where they actually analyze performance into its components."

In speaking about the trade testing movement in 1921, Chapman (p. vi) noted that the "movement is only in its infancy, but the methods that have been evolved will prove a firm foundation upon which an elaborate superstructure can safely be built." Over 60

years later, occupational competency measurement is still in its adolescence.

When one considers the time and the cost required to develop and validate occupational competency measures and the individualized testing and scoring typically required for performance measures, it is not surprising that the full utilization of competency tests has been slow. And yet, as Knaak (1977, p. 39) points out, the development and testing of criterion-referenced knowledge tests and performance checklists is a task of "monumental importance in the competency-based learning system."

Recent Efforts in Vocational Competency Measurement

This section reviews some of the more significant efforts currently under way, or recently concluded, in the area of assessing occupational competencies of students in vocational training programs. Only major projects with direct implications for improving student competency assessment in vocational education are covered here. In addition, commercial test publishers and other organizations are currently working to develop proprietary tests, or testing programs, either under contract to business and professional associations or for direct sale to the public.

Three organizations are now engaged in large-scale programs for developing comprehensive measures of vocational competency, including both paper-and-pencil tests and performance measures:

- The American Institutes for Research
- The National Occupational Competency Testing Institute
- The Florida Department of Education

A complete list of the tests in the final stages of development by the above organizations is contained in Module 18. The test development activities of the three organizations are described on the following pages. More detail will be presented on the American Institutes for Research Vocational Competency Measures project because it was the project that provided the methodology underlying the four modules on student competency testing. An overview of project methods is contained in the Appendices.

The American Institutes for Research (AIR)

In October 1979, AIR was awarded a contract from what is now the Office of Vocational and Adult Education of the U.S. Department of Education to develop, field test, and disseminate comprehensive measures of competency in selected occupational areas.

The Vocational Competency Measures (VCM) project was designed to serve two major purposes: (1) to help teachers and administrators

of secondary and postsecondary vocational education programs evaluate and improve specific areas of their vocational programs; and (2) provide an objective basis for informing students, teachers, and prospective employers about the progress made by students in acquiring specific, job-related competencies.

The specific VCM project objectives are: (1) to develop competency tests in 17 occupations representing the seven major curriculum areas, (2) to establish their usefulness through extensive field testing and validation, (3) to promote their acceptance and use in vocational education programs, and (4) to design and help implement a program for continuing test development on a self-supporting basis.

Tests have been developed for the 17 occupations shown in Table 1.

Each AIR test package includes a paper-and-pencil test of job knowledge; hands-on, performance measures; and a rating scale covering work habits and job-related attitudes important to success on the job.

A look at the AIR tests. A guiding factor in the development of the 17 tests was that each should assess skills and knowledge that employers and supervisors expect from newly hired employees who have completed a vocational training program. The paper-and-pencil tests use a multiple-choice format with most questions having five options. For all but two of the test packages, the paper-and-pencil tests have been divided into two parallel booklets that take about 45 minutes each to complete. The use of two booklets allows administrators and instructors a great deal of flexibility. We strongly recommend that each student be given both test parts, particularly if the test results will be used for student end-of-course certification or where decisions will be made concerning the proficiency of students in individual areas covered by the test. However, it is possible to use one booklet as a screening measure for advance placement and to find out what individual students know of the overall occupation.

The performance tests included in each test package require the examinee to actually carry out some of the entry-level activities expected on the job. These tests use only the equipment and materials normally available in a vocational or technical school offering the specific program. All examinees are not necessarily expected to be tested on the entire set. Deciding which performance tests to administer depends on the uses that will be made of the test scores and on actual job requirements covered in the vocational program.

The test packages contain from four to twelve individual performance tests, some taking as little as five minutes to administer, and a few taking close to an hour. Instructors can select those tests that best apply to their particular training programs. Because these tests are modularized, instructors may administer them at appropriate times throughout a training program, rather than waiting until the end of

TABLE 1

OCCUPATIONAL AREAS COVERED IN THE AIR VOCATIONAL COMPETENCY TESTS

- AGRICULTURE
  - Agricultural Chemicals Applications Technician
  - Farm Equipment Mechanic
- BUSINESS AND OFFICE
  - Computer Operator
  - Word Processing Specialist
- DISTRIBUTIVE EDUCATION
  - Apparel Sales
  - Fabric Sales
  - Grocery Clerk
  - Hotel (Motel) Front Office
- HOME ECONOMICS
  - Custom Sewing
  - Restaurant Services (Waiter, Waitress, Cashier)
- TECHNICAL
  - Electronics Technician
  - Water Treatment Technician
  - Wastewater Treatment Technician
- TRADE AND INDUSTRY
  - Carpenter
  - Diesel Mechanic
- HEALTH
  - Dental Assistant
  - Physical Therapist Assistant

the program. Each performance test includes instructions for the set-up and administration of the test, scoring forms and procedures, instructions to the examinee, and a detailed list of required materials and equipment.

The third component of each competency measures test package is a work habits inventory. This is an assessment instrument covering some of the nontechnical competencies or survival skills judged important for job success in each occupation. Many of these behaviors may be at least as important as technical skills in determining success on the job. The work habits inventory can aid instructors in identifying additional training needed to improve particular work habits and attitudes.

Some of the behaviors included in the current work habits inventory are:

- Organizes work to make best use of time
- Shows cooperation and consideration in working with others
- Gets work done
- Expresses point of view effectively in a group
- Maintains personal appearance suitable for the job

This instrument is <u>not</u> designed to be used in the same way as our technical measures. Rather, it is intended to help improve the communication between student and teacher, and eventually raise the competency of students in many of the job survival skills that may be neglected in the vocational curriculum.

For schools that would like to try out the work habits inventory, we suggest the following steps:

First, administer to new students in a vocational program the list of behaviors our validation findings have shown to be related to that vocation. In this administration, the students would be asked how important they think each behavior will be to their future employers. Instruction on proper work habits can then be based on these results, and should ensure that students <u>know</u> what the employer expects.

Later on in the school year, the students can rate themselves on these same behavioral statements, and at the same time, the instructor can rate each student. These individual student self-ratings can then be compared with the instructor ratings and together serve as a communication tool between student and teacher or student and counselor.

The National Occupational Competency Testing Institute (NOCTI)

For the past 15 years, NOCTI has been actively involved in the development and administration of teacher competency tests in selected trade and industrial occupations. The current series of NOCTI teacher tests consists of 47 examinations covering 38 different occupations. More recently, NOCTI has begun coordinating the development of competency measures for the Student Occupational Competency Achievement Testing (SOCAT) program. In 1979, seven states pooled their resources to develop student tests. The states currently involved in this consortium are Alabama, Florida, Maryland, New Jersey, and Oklahoma. A total of 21 student competency tests are now nearing completion.

The Florida Department of Education

In addition to its responsibility for developing tests as part of the SOCAT Consortium, Florida has its own statewide program for testing student occupational competencies as a means of improving the quality of vocational education programs. This program is mandated under Florida statute for the purposes of educational accountability and for identifying minimal competencies that students must have in order to perform effectively in the occupations for which they are trained. Ultimately, the goal is to provide state certification of competency achievement for students trained in Florida's vocational education programs. Plans call for test items and scoring to be provided by the State Department of Education, with test administration and materials furnished by local school systems, and monitoring conducted by local advisory committee members (Agee, 1980).

Individual Study Activities

1. Select a reference from the Recommended References in the Appendices (or one of your own choosing). Read a chapter or section pertaining to an area in which you are especially interested, such as: military development and uses of competency measures; methods of employment testing; competency-based vocational education, etc. Summarize your readings so that you can discuss your opinions and findings with the class.

2. For your own state or district, select a vocational program or curriculum that you feel might benefit from an improved competency measurement effort. Outline the types of measures and the major topics that you feel should be included in a comprehensive competency measurement program.

Discussion Questions

1. Debate the advantages and the problems of evaluating vocational education programs by deciding on program success on the basis of (a) number of graduates employed in fields for which they were trained versus (b) how well graduates can do the job for which they were trained.

2. Discuss the rationale for including measures of work habits and attitudes in a comprehensive vocational test package. Are work habits and attitudes vocational competencies?

Group Activities

1. Divide the class into three groups and assign each group one of the following topics:

   (a) Job Knowledge Testing
   (b) Performance Testing
   (c) Work Habits and Attitudes Testing

   The groups should be allowed time to discuss their topics and develop a list of categories they feel would be important to cover in developing a test for each assigned topic. It would simplify the activity if each group started with a particular occupation in mind.

2. If possible, the class instructor should obtain a sample test from each of the three groups now developing competency measures (AIR, NOCTI, Florida). Divide the class into three groups, with each group reviewing one of the three test samples. Each group should critique the assigned test, recording their opinions on dimensions such as clarity, comprehensiveness, appropriateness, etc.

GOAL 2: Identify the components of comprehensive student vocational competency measures, and define testing techniques making up those components.

Speaking The Language Of Competency Measurement

Before going any further, let's review what instruments should be included in a comprehensive system of student competency assessment. We also need to define some important terms. Even the term "vocational competency measurement" could stand some clarification. In these modules, vocational competency measurement refers to the process of determining the extent to which a vocational student has acquired the knowledge and skills needed on the job. Normally, such measures would be administered near the end of a training program or at significant points along the way. We are not talking about administering an aptitude test to estimate how well a student can learn a particular course, but rather how much the student knows and can do right now.

The Total Picture

What should be included in a comprehensive program of student competency measurement? To really serve the needs of vocational educators, we believe that three major types of instruments should be included:

- Job Knowledge Test
- Performance Test
- Work Habits Inventory

Let's touch briefly on each of these three measurement areas.

1. Job knowledge testing. This is reasonably straightforward and typically consists of a paper-and-pencil test. If the content of the test is directly relevant to the job, a job knowledge test can be a very cost-effective measure and provide a great deal of information per unit of time. You may have heard this type of test referred to as a "cognitive measure," which is fine if you want to impress your friends. But the term "job knowledge" is perfectly adequate for our purposes.

   A job knowledge test is rarely, if ever, a total measure of job competency. And, just because a test is a paper-and-pencil measure does not mean that it's a measure of job knowledge only. Paper-and-pencil items can also measure some of the skills, such

as problem solving, that are needed on most jobs today. In job areas such as business and office occupations, most of the required skills can be measured with paper-and-pencil tests.

2. Performance testing. In a typical job-sample performance test, we expect the examinee to respond in ways identical or similar to those required on the actual job. Despite the problems of time and cost, performance tests can be expected to provide valuable additional information not normally available from job knowledge tests. For many jobs, performance tests can more nearly match the actual job requirements without the test bias that can result when paper-and-pencil tests are used for jobs that actually have low verbal demands.

   The esoteric label "psychomotor test" has occasionally been used in place of the more general term "performance test." This term is unnecessarily limiting (not to mention the effect that it has on the "Fog Index") because psychomotor tests imply an emphasis on motor skills or eye-hand coordination. Obviously many jobs that exact little demand in the psychomotor area can still benefit from high quality performance tests.

   Performance tests can be further subdivided into:

   - Work samples
   - Simulations

   Work samples are generally defined as tests that use an actual job situation, with the same tools and materials to perform some of the same tasks as those required on the job. Simulations require the examinees to role play or pretend that they are performing a real task. Simulation techniques, however, can range from highly realistic tests, which tend to overlap work samples, to situations where compromises are made in the stimulus or response characteristics in order to reduce testing costs or to gain more control over the testing situation.

3. Work habits inventories. The combination of job knowledge tests and job performance tests still does not tap the full range of demands made upon workers. In order to obtain a job and--even more important--to survive on that job, a person must possess a variety of nontechnical competencies that may be as valuable as technical skills. Coming to work on time, giving the "honest day's work for an honest day's pay," and working effectively with others are examples of these nontechnical competencies that cut across most jobs. Because this assessment area is so heterogeneous, we have labeled it simply as "work habits" rather than use the elegant term "affective instrument."

   The work habits instrument developed by AIR as part of its Vocational Competency Measures (VCM) project was discussed earlier, and suggestions were made for how such an instrument might be used in a vocational program. Because of the exploratory

level of this inventory and of the entire work habits measurement field, no further discussion on the topic is included in this four-module series.

Defining Criterion- and Norm-Referenced Testing

The definitions of criterion-referenced and norm-referenced testing can also breed confusion. As most teachers know, criterion-referenced testing aims at explicit information concerning what an individual can or cannot do, independent of the performance of others; norm-referenced testing provides information on the relative standing of individuals with respect to a given task. This definition may give the impression that criterion-referenced testing and norm-referenced testing are mutually exclusive, which need not be the case. For example, the performance of examinees can be useful information for setting realistic performance standards in criterion-referenced tests.

To give more precision to the definition of criterion-referenced testing, a number of educators have subdivided criterion-referenced tests into two major categories:

- Domain-referenced tests
- Objectives-referenced tests

In a domain-referenced test, the score indicates what percentage of the specified domain the examinee has mastered. In contrast, the items in an objectives-referenced test, although matched to objectives, are not considered a representative sample of items from a clearly defined domain.

Because this area is still in a state of flux, the best advice to educators is not to assume that all authors or speakers mean the same thing when they use the terms "criterion-referenced," "domain-referenced," or "objectives-referenced."

Individual Study Activities

1. Write your definitions of the following terms:

   (a) vocational competency measurement
   (b) performance testing
   (c) criterion-referenced testing
   (d) norm-referenced testing

   You may want to use a standard text on testing or references listed in the Appendices to help you arrive at a definition.

   Under Goal 2 in Module 9, you will find a discussion of ways to assess student achievement that might also be useful for this activity.

2. Select a vocational course or program with which you are familiar. List several competencies that are taught in the program and should be tested. Then divide the list into two sections: competencies best tested by paper-and-pencil and competencies best tested by performance. In making your judgements, be sure to consider the limits presented by situations such as time restraints and the need for individual test administration.

Discussion Questions

1. Discuss the advantages and disadvantages of the following testing methods:

   (a) Work sample vs. simulation
   (b) Paper-and-pencil vs. performance testing
   (c) Criterion- vs. norm-referenced testing
   (d) Domain vs. objectives-referenced testing

2. Some educators are hesitant when asked to use any affective instrument to assess attitudes. Discuss how to use an affective instrument such as a work habits inventory to enhance student learning and vocational program improvement without raising fears about "values," etc.

Group Activities

1. Ask small groups (2-3) in the class to select a vocational program at a local high school, proprietary school, technical institute, or community college where competency testing is used. Each group should be responsible for arranging to observe a class (or individuals) in the selected program during a testing situation. Note and record your observations, including how the testing is set up and introduced to the student(s), and the methods for rating which competencies are accomplished or not achieved. Then report during the next class session on each group's observations.

GOAL 3: Analyze the use of competency measures for evaluation, instruction and administration, and communication.

Specific Application Of Vocational Competency Measurement

Vocational competency measures can assist educators and administrators in three major areas:

- Evaluation
- Teaching and Administration
- Communication

These areas can be further subdivided into the functions shown in Figure 1. This does not mean that every test can serve all of these functions or that a particular test that is useful for one function will necessarily be as valuable for other functions. The value of a test will depend both on its content and how it is used. In particular, the strategy and timing of test administration will influence the usefulness of a test.

Evaluation

When educational evaluation is discussed, it is easy to jump to the conclusion that the only decisions to be made are whether or not to cancel a program, or whether to reduce or increase its financial support. Without detracting from the importance of these decisions, we feel this is a very limited view of evaluation. If vocational competency measures only help in making these "summative" decisions, we understand why most teachers would want nothing to do with such measures. Fortunately, competency tests can provide much more information to help with "formative" decisions--what parts of a course or program need improvement and what parts of a course are achieving objectives of imparting occupational knowledge and skills to students.

Teaching and Administration

Throughout the entire teaching and administration process, vocational competency measures can provide essential information for good decision making. This contribution reaches its peak in a truly competency-based vocational program that relies on regular measurement of student achievement on specific instructional

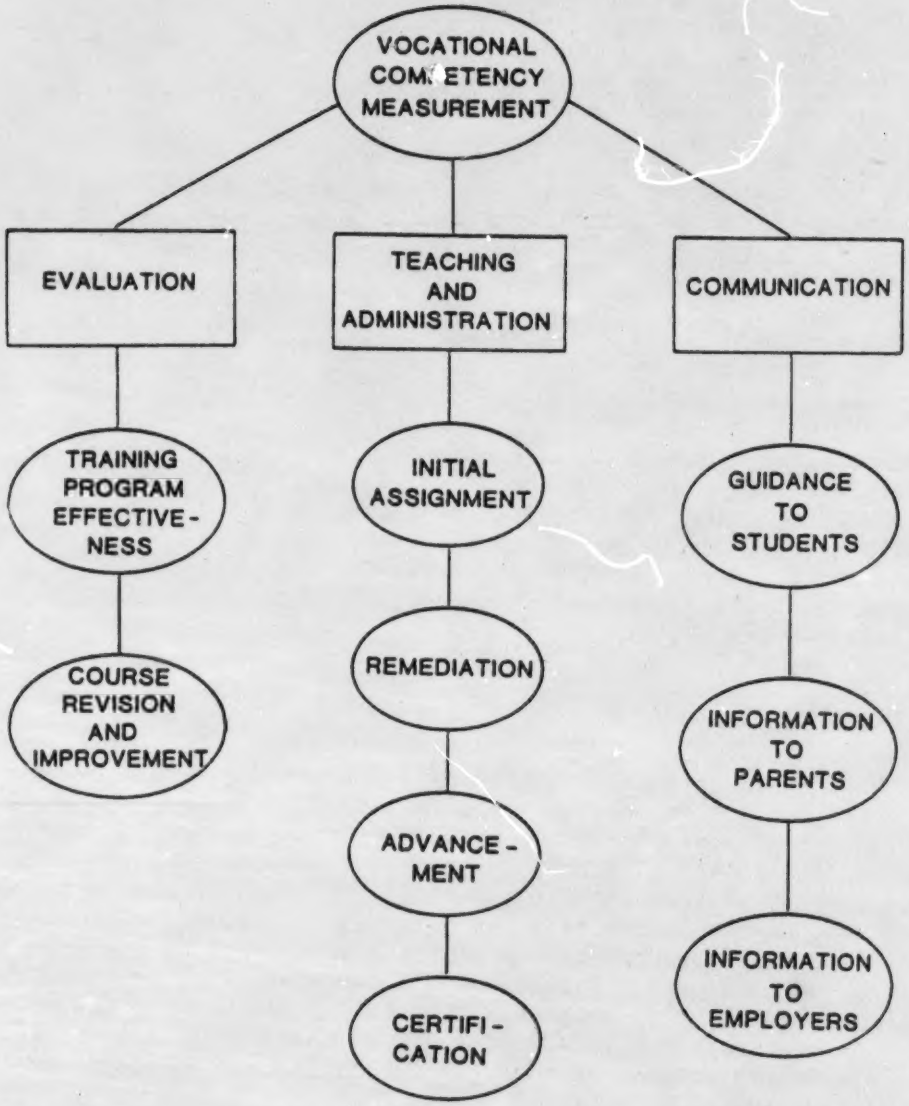

Figure 1. Role of competency measurement in vocational education

objectives. The major milestones where competency measurement is vital are:

- Initial assignment
- Remediation
- Advancement
- Certification

Initial assignment. Knowing the capabilities of your new students can be a big help--and not just to teachers in an open-entry program. There's no sense in wasting your time or the students' time teaching skills that they already possess. And trying to teach an intermediate or advanced concept or skill if some of the students lack the enabling skills or prerequisites can also be wasteful, frustrating, and even dangerous.

A judicious administration of a selected group of "pretests" could really help you to adapt or individualize your program, if only on a modest scale. You might also use the results to form more homogenous small groups, on the basis of how much of your attention these groups need. That way, you can concentrate your efforts on those students who really need your help while allowing the more advanced groups to work more on their own.

Remediation. Spotting gaps in student knowledge or skill areas is another way that competency measurement can support the teaching process. This is true whether you prefer working either with your total class or with individual students. Test results, if sufficiently "fine grained," can spot weaknesses objectively and efficiently. The scores are there for both you and the students to see specifically where improvement is needed. By using test scores, and other available information on student needs, you and your students can agree on what actions should be taken or alternative instruction methods used to correct deficiencies.

Advancement. Progress measures can be the same measures as those you might use for remediation. Not every test that's appropriate for use in advancement, however, is adequate for diagnostic purposes. For diagnosing weaknesses and preparing remediation plans, we need to have a considerable amount of detail to pinpoint where a student is having trouble. In contrast, an advancement test may be more global and need only certify that a particular performance objective has or has not been achieved.

Certification. Schaefer and Huang have stressed the importance of measuring student proficiency at the end of a training program. They noted that "...we, the vocational educators, have steadfastly denied the majority of our graduates the chance to prove to themselves that 'I can do something and do it well'" (1978, p. 40). Such measures, they note, "would certainly help to put our house in order, more so than any other tool of education" (p. 41).

Not every vocational educator will be as enthusiastic about end-of-program measures as these educators; nevertheless, a growing number are looking toward certification as a meaningful indicator of accomplishment.

Communication

While communication is an underlying component of all test uses, there are particular times when the communication functions of a test are paramount. For example, students need feedback periodically during a training program both for reassurance and to indicate where outside help or greater effort is needed. Test scores can serve this purpose or, if necessary, can help provide the back-up data if a student requires counseling to change career plans. For minor students, the same information should be given to the parents.

Finally, the results of objective, end-of-program competency measures can supply the detailed communication that employers are searching for as they decide on hiring of applicants and the placement of employees. What can a job applicant do and what does the applicant know that will make that person a valuable employee? Grade reports or school transcripts can't begin to answer these questions as adequately as can the results of competency tests.

One caution should be noted. Be sure that you have the approval of the student (or the parent, if the student is a minor) before you release this information to a prospective employer.

Don't Expect a Panacea

Speaking about cautions, it's time to stress that, while tests can provide information that is not readily available from other sources, they are definitely not a panacea or a substitute for careful decision making. A recent report on ability testing from the National Research Council's Committee on Ability Testing addresses this issue directly (Wigdor & Garner, 1982):

> Americans have, on the whole, expected too much of tests and, conversely, have blamed too much on tests. People have wanted tests to produce social justice, to be "fair" in some absolute sense. And, when disappointed in the results of the testing process, people have charged them with being "unfair," with producing inequality (p. 206).
>
> When people stop thinking of tests as panaceas or using them as scapegoats, when they understand that testing is a useful, but limited, means of estimating one of the characteristics of interest in selecting or assessing people, i.e., ability or talent, then a good part of the conflict about testing will be alleviated (p. 208).

While we have no doubt that student competency tests can make valuable contributions to decision making in vocational education, each time that test data are used, we should keep in mind that we can't measure everything of importance and what we do measure must be based on a limited sampling of behavior. On many occasions, AIR staff have been approached by vocational educators and administrators wanting to use our test content when they design or revise a curriculum. If the test covered all of the competencies that are expected of graduates when they obtain their first job, this wouldn't necessarily present a problem, providing the test were used only for general guidance and not directly included in the curriculum. Realistically, no test can cover all the competencies adequately, when testing time is justifiably restricted to a few hours. Test limitations due to restrictions on the length of the test must always be kept in mind by curriculum developers.

On the topic of test limitations, the National Research Council's Committee on Ability Testing again makes a cogent observation:

> The limitations of testing technology and the problems caused by its misuse lead us to a cautionary conclusion. Tests are tools. They provide an efficient way to gather certain kinds of information systematically and they extend to decisionmaker one means of making judgments about people. But when a test score is taken out of context and treated as if it tells all that matters about a person, scientific assessment is degraded to dogma.

Recognizing these limitations on the use of test scores, we should be sensitive to the legal issues surrounding competency testing in vocational education. In looking to the future, Tractenberg makes the following recommendations:

> Vocational educators should not simply sit back and wait to be sued. They should deal in some preventive maintenance--they should attempt to head off legal challenges by fashioning and implementing performance testing programs in the most careful manner possible. If they do so, the law and the courts will have been an important partner in educational and professional reform (p. 103).

Now that you've seen the many ways where tests can be helpful, as well as some of the cautions that should be kept in mind, we hope you will still want to pursue the topic further. The next module in this series takes you through the first step in wise test usage, determining requirements for vocational competency measures.

Individual Study Activities

1. Select a basic reference on evaluation of vocational education. Some are listed in the Appendices of this module and in Modules 9 and 12. Read the specific sections dealing either with evaluating students or with evaluating curricula. Prepare a brief paper on the evaluation methods, limitations, and uses presented in your selected reference.

2. Find several newspaper or journal articles on the controversies surrounding minimum competency testing of basic skills and prepare a brief paper on the implications for vocational competency testing.

Discussion Questions

1. Discuss the problems inherent in communicating test results to:

   (a) students
   (b) parents (if applicable)
   (c) employers

   For each problem, arrive at a communication method that would alleviate or prevent the problem presented.

2. Discuss some of the limitations to using the content of a competency test to design or revise a vocational curriculum.

3. Compare the benefits (and drawbacks) of using competency test scores rather than course grades or school transcripts for communicating with prospective employers about vocational graduates.

Group Activity

1. Assign each of three groups one of the following functions of competency testing:

   - Evaluation
   - Teaching and Administration
   - Communication

   Ask each group to develop a checklist that can be used in their own school, district, or state to examine an existing vocational testing program on the assigned function. For example, the group developing a checklist for using competency test results for evaluation might consider the following questions:

- How and when can evaluation methods be used to measure program (or course) effectiveness?

- How can evaluation results be used to help decide what instructional methods, program content, etc., should be changed?

Summary

The concept of measuring achievement in vocational training programs through competency testing is not new. Historically, the military services took the lead in developing and using competency measures for assessing student progress. Most recently, the trend toward more competency-based vocational education programs has increased the demand for assessing students on the basis of competencies.

Some of the current efforts in vocational competency measures are through projects conducted by the American Institutes for Research (AIR), the National Occupational Competency Testing Institute (NOCTI), and the Florida Department of Education. Testing components in the AIR Vocational Competency Measures project include: a paper-and-pencil test of job knowledge; a set of hands-on performance tests; and a rating scale or inventory of work habits and attitudes.

The uses of a comprehensive package of student competency measures are varied. Three basic functions are evaluation, teaching and administration, and communication. Within these functions are a range of activities from using results of competency measurement to improve a vocational curriculum, to helping educators communicate with students about their progress.

APPENDICES

Summary of VCM Project Methods

The Vocational Competency Measures Project has been divided into three major stages: (1) occupational study, (2) test development and analyses, and (3) dissemination and technical assistance.

Occupational study. In order to ensure that our tests reflect actual job requirements, task inventories were prepared for each occupational area selected for test development. Previous task analysis data were used wherever possible, and the on-the-job performance of these tasks was verified through interviews with employers and employees across the country. Altogether, interviews were conducted in 26 states and the District of Columbia. The task verification data were analyzed to identify tasks that should be included in the competency measures.

Test development and analyses. The test development and analysis stage involved technical experts working with AIR staff to prepare the final test outline, the individual test items, and the job-sample problems. Each test was then reviewed by at least four experts representing employers and educators who had not developed the test items. This review was important to guarantee that the tests reflect real job demands and, at the same time, are sensitive to the problems faced by vocational educators. Based on the reviews, each test was revised and pilot tested on small groups of students in at least two separate sites.

The competency measures were then field tested in vocational education programs across the U.S. Altogether, over 3500 students at more than 150 sites in 37 states, participated in the field testing phase. The results of the field testing provided the basis for a thorough revision of test content and format.

The next step was to validate the tests in the job environment so that vocational educators could depend on the tests as meeting current job requirements. Two strategies were used for test validation. For content validation, the primary approach, employers and supervisors critically reviewed the tests to determine how well the content matched the actual job demands. As a supplement to the content validity review, employers volunteered to administer portions of the tests to samples of employees to determine whether performance on the test correlated with performance in the work environment--in other words, whether those who do well on the test also do well on the job. This strategy is often referred to as concurrent validity. Over 1600 content validity checklists were completed by employers throughout the 50 states, and approximately 150 civilian employers and military units administered the tests and returned sufficiently complete data for analysis.

Dissemination and technical assistance. This third stage has actually been under way since the early months of the project. Virtually every project task has had a related dissemination activity. Our specific dissemination products and efforts have included the following:

- Project abstract
- Project brochure
- UPDATE (our periodic communication link with over 2000 individuals and institutions)
- Journal articles
- News releases
- Presentations at state and national vocational education conventions
- Targeted presentations to state and local vocational education departments
- Technical assistance manuals covering the effective use, development, and evaluation of vocational competency measures

Self-Check

GOAL 1

1. Describe the advantages that competency testing has over employment rate as a criterion for evaluating vocational education effectiveness.

2. List at least three ways that competency-based vocational education is linked to competency testing.

3. Name four organizations that have been or are involved in developing competency measures for vocational training programs.

4. Briefly describe the three components of AIR's comprehensive Vocational Competency Measurement program.

GOAL 2

1. Define vocational competency measurement in your own words.

2. Describe briefly how the three major types of instruments that should be included in a comprehensive set of vocational competency measures differ from each other.

3. For each of the above instruments, state one advantage and one problem in its use with vocational students.

4. For your own understanding of the terms, define criterion-referenced and norm-referenced testing.

GOAL 3

1. For each of the functions of vocational competency measurement listed below, suggest one use you might make of a vocational competency measurement program:

   - Evaluation
   - Teaching and Administration
   - Communication

2. Can the same competency measures be used for initial placement, diagnosis, advancement, and certification? In what ways should each of the tests or their uses differ for each purpose.

3. What are the major limitations of student competency tests? What are some major contributions of vocational student competency tests?

Self-Check Responses

GOAL 1

1. Not all students in vocational programs are serious about making a career in the field covered by the program. Local economic conditions influence the likelihood of a student (especially a high school student) getting a job in the field where trained.

2. Pre-testing entering students

   Advancing students on achievement of objectives .

   Providing remedial or alternate instruction for students

   Measuring proficiency at the end of a course or program

   Recording or certifying student achievement of objectives or competencies

3. U.S. Military services; AIR; NOCTI; Florida State Department of Education

4. Job knowledge test (paper-and-pencil); cognitive

   Performance test (simulation or work sample); hands-on; psychomotor

   Work habits and attitudes (inventory of behaviors); affective

GOAL 2

1. Vocational competency measurement is the process for determining the extent to which a vocational student has acquired the knowledge and skills needed on the job

2. Job knowledge test usually measures factual information about a job; paper-and-pencil test

   Performance test usually measures actual on-the-job skills by a work sample or simulation technique

   Work habits inventory is directed toward evaluating work-related behaviors that are nontechnical

3. Paper-and-pencil test: limited mostly to knowledge, not skills; dependent on verbal ability of student; cost-effective, easy to administer and score

Performance test: limited by cost and time required for administration; does not usually cover all skills required on a job; measures student skills without depending on verbal ability; best predictor of performance on the job

4. Criterion-referenced: measures explicitly what an individual can or cannot do toward meeting a performance objective

   Norm-referenced: measures performance of individuals based on their relative standing among all others tested on the same measures

GOAL 3

1. Evaluation--using results to review particular curriculum, find weak areas, revise courses, etc.

   Teaching and administration--deciding where to place entering students; how and where to provide remedial coursework or alternative instruction; certifying students as objectives are achieved

   Communication--informing students about strengths and weaknesses; providing rationale for parents about need for improvement; referring students to potential employers

2. Remediation: test must focus on details

   Advancement/certification: outcomes (end-of-program) results are important

3. Limitations of vocational competency tests:

   - performance tests require more skill, time, individualized attention, preparation than paper-and-pencil tests

   - measuring competencies adequately requires combination of tests and methods to judge levels of knowledge, skills, attitudes; everything can't be measured

   Contributions of vocational competency tests:

   - bias-free testing

   - measurement of job-related (not education-related) performance

   - clear definition of strengths and weaknesses to help in deciding about programs, curricula, student progress

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